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THE SIBERIAN SEA ROAD: THE WORK OF THE RUSSIAN HYDROGRAPHICAL EXPEDITION TO THE ARCTIC 1910-1915

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THE SIBERIAN SEA ROAD

THE WORK OF THE RUSSIAN HYDROGRAPHICAL EXPEDITION TO THE ARCTIC 1910-1915

By N. A. TRANSEHE

Late Commander, Russian Navy

[With separate map, Pl. III, facing p. 398]

The Great Northern, or Siberian, Sea Road, or, as it is commonly called, the Northeast Passage, has attracted more or less attention since the sixteenth century, when various nations of western Europe tried to find thereby a more advantageous route to Cathay. As is well known, the passage has been accomplished only within the last fifty years, having been made for the first time by the distinguished Swedish explorer A. E. Nordenskiöld on the *Vega*, sailing from west to east in 1878-1879. It is not so generally known that the passage was made in the opposite direction, from east to west, in 1914-1915 by the Russian Hydrographical Expedition to the Arctic. The route of the expedition, the extent of newly surveyed coast including Nicholas II Land, and other results are shown on the map (Pl. III, facing p. 398).

THE EARLIER EXPLORATIONS

Even up to the eighteenth century the possibility of such a route remained unknown or doubtful. The relation between Asia and America was only definitely determined by the Great Northern Expedition, planned by Peter the Great and put into execution by his successors. It is to Bering's voyages and the subsidiary expeditions that we owe the first authentic maps of the northeastern coasts of the continent. The work of the Great Northern Expedition has scarcely had the recognition it deserves.¹

Exploration of the northern territories was continued by various Russian expeditions without startling event, until Nordenskiöld's exploit proved the passage to be feasible. A little later under the auspices of the Russian Navy there developed great activity in the exploration of the Kara Sea route to the Yenisei River. A commercial waterway from Europe to the heart of Siberia was being sought in connection with the Siberian Railroad then in the process of construction. Before that Nansen on the *Fram* had gone by the Kara Sea (1893) eastward to the New Siberian Islands, from which point he began his famous drift.

In 1900 the expedition of the *Zarya*, under the command of Baron Toll, reached the Nordenskiöld Archipelago by way of the Kara Sea. The expedition wintered there in 1900-1901 and at the New Siberian Islands

¹ F. A. Golder: Bering's Voyages, Vol. 1, *Amer. Geogr. Soc. Research Series No. 1*, 1922.



FIG. 1

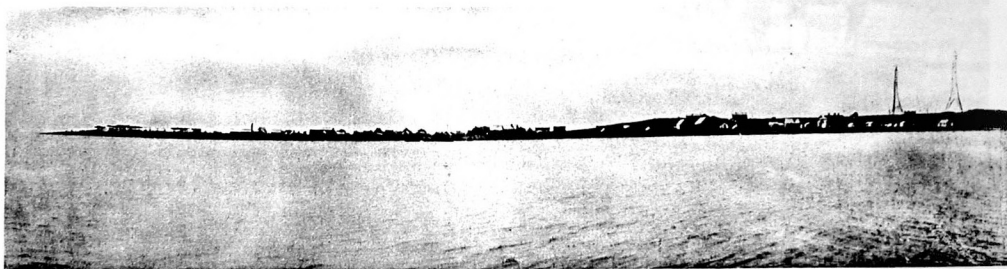


FIG. 2

FIG. 1—Petropavlovsk, capital of Kamchatka, was a port of call for the expedition between the base in Vladivostok and the Arctic Ocean. In the background is the snow-capped volcano Avacha.

FIG. 2—Novo Mariinsk at the mouth of Anadir Bay, one of the last ports of call for the expedition before entering the Arctic Ocean.



FIG. 3



FIG. 4

FIG. 3—Cape Dejnev, named for the Cossack hunter to whom has been attributed the prior discovery of Bering Strait in 1648. Chukchi settlement at the right (see Fig. 4).
 FIG. 4—Chukchi settlement at Cape Dejnev (see Fig. 3).

the next year, after which Tiksi Bay, in the mouth of the Lena River, was reached, where the vessel was abandoned on account of lack of coal.

It is not generally known that a participator in this expedition was the late Admiral (then Lieutenant) Kolchak. He made a notable journey by whaleboat from the mouth of the Lena River to Bennett Island in search of Baron Toll. While he did not succeed in tracing the lost members of the expedition, he found their camp and returned to the mouth of the Lena by the same way, bringing with him Toll's diary and part of his collections. Kolchak's work "The Ice of the Kara and Siberian Seas," presenting his systematic observations of sea water and ice cover for two years of navigation on the *Zarya*, was published by the Academy of Sciences.

The *Zarya* was the last scientific expedition engaged in exploration of the waters that wash the shores of northern Russia up to the mouth of the Lena River. For the part of the Arctic Ocean from the Lena to the Kolima River and beyond to Bering Strait the situation was still worse, as since the Great Northern Expedition the explorations undertaken in this region had been more limited in scope. These included the Russian expeditions of Lieutenants Anjou, Wrangel, and others; that of the *Vega*; the unfortunate American expedition of Lieutenant De Long on the *Jeannette*; and a number of Russian coast expeditions and isolated whaling ventures which had penetrated into the waters of the Arctic Ocean along the coasts of Siberia, a distance of a few score miles or so, seldom of 100 miles, from Bering Strait.

The data gathered by these voyages and explorations were insufficient to determine the possibilities for the establishment of regular navigation—which time and circumstance now brought to the fore as a desideratum.

During the Russo-Japanese War Russia had been compelled to transfer its Baltic fleet to the Far East through three oceans, from the Atlantic to the Pacific. After the war interest was directed to the hope, a slight one it is true, of utilizing the Northeast Passage in similar cases in the future. The Navy, which had indeed been interested in the exploration of the northern waters since the time of the Great Northern Expedition, was desirous of putting it to the test. From Archangel to Vladivostok via Bering Strait is a distance of about 6000 miles, about half that of the route from the Baltic through the Indian Ocean.

Still more important than the strategic were the economic considerations, viz. the provisioning of northeastern Siberia by a cheaper way—from Vladivostok by sea through the Arctic Ocean into the Kolima River, instead of the way, as practiced at the time, of transporting supplies down the Lena River, then by dogs or deer to the Kolima River and the Government warehouses. Some attempt at commercial communication by sea from Vladivostok to the Kolima was indeed already in progress. The result of these eminently practical considerations was the creation of the Russian Hydrographical Expedition to the Arctic Ocean.

THE RUSSIAN HYDROGRAPHICAL EXPEDITION CREATED

In Petrograd two vessels, the *Taimir* and the *Vaigach*, were constructed. These vessels were sister ships of ice-cutting type, i. e. made of iron and built on the lines of the *Fram*. Each vessel was of 1500 tons displacement and carried 500 tons of coal, sufficient for a speed of eight knots during 60 days of navigation, or for 12,000 miles. Each ship was equipped with wireless with a transmission capacity of 100-120 miles. The personnel of each vessel was five officers, one mechanical engineer, one doctor, and a crew of 40. Food supply (mostly canned) was carried for 16 months and customary Arctic outfit except that there were no dogs, owing to the lack of space for them and their food. There was complete equipment for work in cartography, meteorology, oceanography—including biology of the ocean—and in other branches of natural sciences.

In the spring of 1909 the vessels were launched from the dockyards, and in autumn of the same year they sailed from Petrograd to Vladivostok through the Indian Ocean, there to establish the expedition's base. Kolchak, who was the organizer and leading spirit of the expedition, was first in command and sailed on the *Vaigach*—Mattisen, who also had been a member of the *Zarya* expedition, being in command of the *Taimir*.

The main reason for the transfer of the base of the expedition was that the eastern portion of the route remained almost unexplored, whereas hydrographical knowledge of the Kara Sea was steadily advancing, more or less regular navigation to the mouths of the Ob and Yenisei Rivers having been in progress since 1867. The expedition also would have the opportunity of doing hydrographical work on its voyages from Vladivostok to the Arctic Ocean, a distance of 3000 miles. Furthermore, it was planned to attempt the Northeast Passage as a culmination to the systematic work, and an approach from the east offered a slight advantage (10-12 days), precious when navigation time is so short, two months at the maximum. Besides these considerations it was thought expedient to put the newly built vessels to a test by the long journey to Vladivostok, a wise foresight as it proved.

WORK OF 1910 AND 1911

Because of the delay entailed by boiler repairs the expedition during 1910 made only a brief reconnaissance trip into the Arctic Ocean as far as Cape Intsov and back to Vladivostok, carrying out some hydrographical research work in the Bering Sea.

The following year the expedition was deprived of its director and commander, Kolchak, having previously lost Mattisen, both men of experience in polar navigation.

The instructions for the year's work are typical. They were:

1. To make a survey of the coasts and adjoining islands from Cape Dejnev westward. The basis for the survey was to be astronomical sta-



FIG. 5



FIG. 6



FIG. 7

FIG. 5—Drift ice aground on the coast of Jekhov Island.

FIG. 6—Tundra in Kolyuchin Bay: grave of the sailor Byeliak.

FIG. 7—Sledge party in search of Baron Toll's collection on Bennett Island.



FIG. 8



FIG. 9



FIG. 10

FIG. 8—Ice pushed up on shore at Cape Chelyuskin.

FIG. 9—The western coast of Taimir Peninsula: astronomical beacon and graves of Lieutenant Jokhov and the sailor Ladonichev.

FIG. 10—Crossing a river in the tundra.

tions on the coast at distances of 50-60 miles from each other, if possible. Soundings were to be made along the entire route.

2. To make a survey of bays, mouths of rivers, anchorages in general, and especially anchorages of rivers, which would serve as places of shelter from ice. The survey of the safest anchorages was to be made by plane-table and soundings from the ships' boats.

3. To establish signals for the needs of navigation, also in anchorages which would serve as refuge places from ice.

4. To perform hydrological, magnetic, meteorological, and biological research.

5. To make surveys of currents and movements of ice.

6. To take soundings on lines normal to the coast, in order to determine the general character of the relief of the bottom.

In addition the program was always to include the following:

1. Hydrographical work on the way from Vladivostok to the Arctic Ocean, primarily along the coasts of Kamchatka and Bering Sea.

2. Notes on sailing direction in the Arctic Ocean and of the route from Vladivostok to Cape Dejnev.

Upon completion of the systematic work to the mouth of the Lena River the expedition was instructed, if the conditions of the ice permitted, to proceed with the survey farther to the west, to the north of Cape Chelyuskin along the western coasts of the Taimir Peninsula.

Following the above-named instructions and having, for 1911, a limited area of exploration in the Arctic, i. e. to the mouth of the Indigirka River, the expedition under its new command started out from Vladivostok, completed the prescribed work to Cape Dejnev and from there, entering the Arctic Ocean, proceeded to fulfill its chief task—the coastal survey.

Encountering on the way varying conditions of ice and from time to time being held up by it, the expedition reached as far as the mouth of the Kolima River. On the way back a tack was made to Wrangel Island. On the southwestern extremity an astronomical station was established from the *Vaigach*, and the west coast of the island was surveyed: the northern shore could not be approached near enough for surveying. As a result of the season's work the Hydrographic Office the following year published a map of the Arctic Ocean from Dejnev to Kolima, with the addition of Wrangel Island, according to the new data.

During 1911, for the first time, the steamer *Kolima* of the Volunteer Fleet made a successful commercial voyage from Vladivostok to the Kolima River and back, inaugurating a regular steamship service along this route.

WORK OF 1912

During this year the expedition started out from Vladivostok with the intention of spending a month and a half in hydrographical work

along the coast of Kamchatka and the Bering Sea. The Arctic Ch entered on July 27, 1900, and was accompanied only by a few small boats. With some knowledge of the conditions prevailing at that time, it is probable that the Arctic Ch, if it had, depending on the weather, could have reached the mouth of the Lena River.



FIG. 11



FIG. 12

FIG. 11—Driftwood at Cape Titka, Blijni Island of the New Siberian group. The wood is probably carried thither from the mouth of the Lena River.

FIG. 12—Driftwood at the mouth of the Kolima River.

along the coasts of Kamchatka and Bering Sea. The Arctic Ocean was entered on July 22,² up to which time ice was encountered only in Anadir Bay. With minor delays on account of ice conditions, primarily on the line from North (Syeverni) Cape to Wrangel Island, the expedition reached the mouth of the Kolima River on July 29 and, directing its course toward the Bear Islands, made a survey of them, establishing astronomical stations thereon. From the Bear Islands to the meridian of the Indigirka River and beyond to Laptev Strait it was impossible to approach within 20 miles of the coast because of the shallowness of the water (depth 20 feet).

The New Siberian Islands were reached on August 9. After the position of Cape Titka on Blijni Island had been established a survey of the southern coasts of the entire group of the islands was made. The expedition then crossed Laptev Strait and defined Cape Svyatoi Nos, while the astronomical station established during one of the previous coast expeditions was connected by triangulation with the one established during this expedition, a fact of great value for the correction of all coördinates of observations of the coast expeditions.³ On the way from Cape Svyatoi Nos to the mouth of the Lena River, a partial survey of the coast was made, and on August 22 the expedition arrived in Tiksi Bay to the south of the delta of the Lena, where was seen Baron Toll's yacht *Zarya*, abandoned for lack of coal in 1902. Tiksi Bay may sometime serve as an outpost for the Lena River.

In this neighborhood a souvenir of the tragic expedition of Lieutenant De Long was encountered. A Tungus, Afanasi Bobrovski, visited the vessel; before entering into conversation he solemnly took out from a box two medals and hung them on his breast. One, gold, had been given to him by the President of the United States for "Courage and Humanness;" the other, silver, was from the Russian Government for "saving the perishing." Bobrovski related that he received these medals for services rendered to Melville of De Long's expedition.

On August 28 the expedition set forth again, doubling the delta of the Lena River and shaping its course toward Cape Chelyuskin. Impassable ice, however, soon compelled it to turn to the south near the mouth of the Anabara River. Here precious time was wasted in irresolute action, the expedition moving along the coast back and forth until September 5, when it was announced that it would return to Vladivostok. Without accomplishing further work, except some soundings and meteorological observations, the expedition proceeded to Cape Dejnev, anchoring there on the 22nd. On the way to the cape walrus hunting was engaged in, which supplied the Zoölogical Museum of Petrograd with excellent specimens.

² The new calendar is used in all instances.

³ The principal astronomical positions found by the expedition were made on land. Latitude, local time, and azimuth were determined in most cases with great precision by observations on stars with a large Hildebrand micrometer theodolite. Differences of longitude were determined by the transportation of twelve chronometers, each of which was checked for rate before and after the expedition.

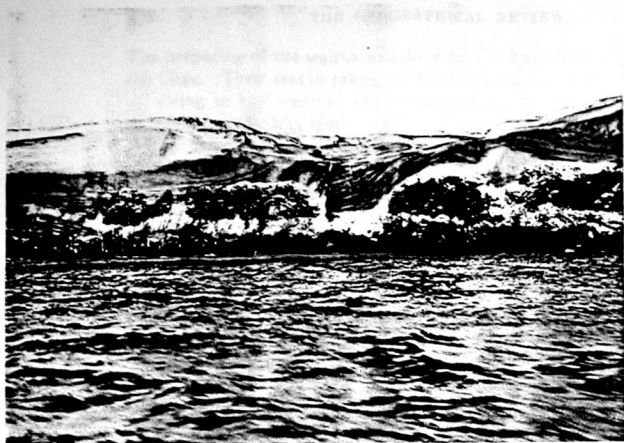


FIG. 13

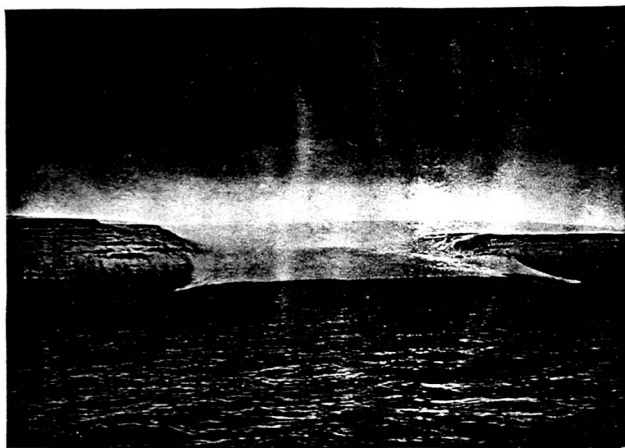


FIG. 14

FIGS. 13 and 14—The northern (Fig. 13) and southern (Fig. 14) shores of Bennett Island. Snow fields occur on the northern shores, but glaciers do not descend to the sea as they do on the southern side of the island.

The preparing of the walrus was done by Chukchi, from a settlement near the Cape. Their zeal in taking off the hides was explained by their hunger as, owing to bad weather and absence of sea beasts, the population was suffering from lack of food.

The cartographic work of the seasons 1911 and 1912 may be summarized thus:

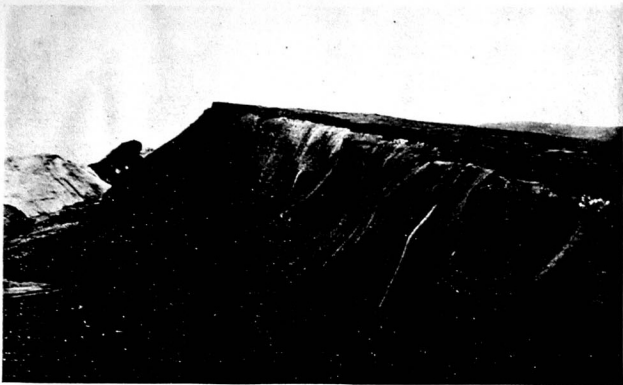


FIG. 15.—A cliff of ground ice on Vasilievski Island, one of the New Siberian group, where the phenomenon attains a remarkable development. Compare with the illustrations from Baron Toll reproduced by Leffingwell in "The Canning River Region, Northern Alaska," *U. S. Geol. Survey Professional Paper 109*, 1919 (Pls. 33 and 34), and see also Leffingwell's discussion of the ground-ice problem.

1. On the Arctic coasts 17 astronomical stations were established, and 5 on the coast of Kamchatka.
2. A survey of the coast from Cape Dejnev to the Kolima River was made.
3. A survey of part of Wrangel Island was made.
4. A survey of parts of the Bear and New Siberian Islands was made.
5. A survey of parts of the coasts of Laptev Strait and of the Anabara River was made.
6. Errors as to the longitude of the eastern Taimir Peninsula were determined.
7. On the entire route soundings were carried out, in some places with the construction of hydrologic sections showing the currents at various depths.

The work done permitted material correction of existing maps of the Arctic Ocean and the preparation of sailing directions for the Arctic as far as the Lena River.

THE WORK OF 1913

In contrast with the preceding work directed primarily to an immediate commercial objective, the navigation of 1913 was one of wide exploration which resulted in important geographical discoveries. On August 5 the expedition, after battling with the ice in Anadir Bay, entered the Arctic Ocean. The *Vaigach* proceeded to Wrangel Island but was unable to ap-



FIG. 16—Tundra in the neighborhood of Tiksi Bay. The cone-shaped hills represent the dissection of the ground ice (see Fig. 15). The hills are of earth covered with a layer of sward several inches in thickness; between is seen ground ice. The hills are separated from the sea by a strip of river sand. Compare the description by Colonel Neyelov: *Report of the Russian Hydrographic Office*, Vol. 38, 1914, pp. 68-113; reference on pp. 79-82.

proach its shores because of ice. A survey of the Bear Islands was made, and thence the vessel sailed along the coast via Laptev Strait towards the Taimir Peninsula. Shallow waters prevented the survey of the mouth of the Olenek River, but some important work was done in Nordvik Bay. The supposed peninsula at the southeastern side of the bay was found to be an island. Its southern shores were surveyed. Hydrological sections were made in the bay, the depth of which ranged from 11 to less than 4 fathoms. While in the shallows a six-foot ebb left the *Vaigach* stranded, but she was refloated by the returning high tide. She grounded again later in latitude $75^{\circ} 30' N.$ while surveying Pronchishcheva Gulf. The *Taimir* proceeded along the coast, completing the soundings in Chaun Bay and thence turning northward to the New Siberian Islands. On August 20 the *Taimir* discovered a small island, one and a half miles in diameter and with an elevation of 50 feet, subsequently named General Vilkitski. On August 23 the *Taimir* met the *Vaigach* at the rendezvous agreed on, Preobrajenie Island.

On August 28 the vessels proceeded northward to survey the coast of the peninsula and of the numerous groups of fringing islands. On September 1 the vessels were stopped by ice from three to five feet thick near Cape Chelyuskin. From the meridian of the Bear Islands or even a little farther east no ice obstruction had been encountered up to this point—an exceptionally favorable condition.

DISCOVERY OF NICHOLAS II LAND

In search of open waters to the west the vessels went north. On September 2 a low island was discovered, later named Tsarevich Alexis, 30 nautical miles northeast of Cape Chelyuskin. A survey was made along its southern and eastern coasts. Doubling the island from the east, the expedition went to the northwest, passing several icebergs on the way.

On September 3 the expedition made its major discovery—Nicholas II Land. The significance of this discovery has already been briefly noted in the *Bulletin of the American Geographical Society*.⁴ It showed the existence of Chelyuskin Strait and of land stretching far towards the Pole. The existence of such land helps to explain many of the hydrographical peculiarities of the Kara Sea: it also has a meteorological interest. The expedition approached the southeastern extremity of the new land (55 miles from Chelyuskin) but, finding no open water to the west, started a survey along the eastern coast which, in the form of flat-topped mountains, attains a height of 1500 feet. A southwest wind drove away the masses of ice from the coast, forming a wide channel for the passage of the ship. On September 4 astronomical observations gave a position of latitude $80^{\circ} 4' N.$ and longitude $97^{\circ} 12' E.$ Thence compact ice was encountered, which barred the way northward at a latitude of 81° . How much farther north the new land extends remains to be determined. Its maximum dimensions, however, are approximately known from the findings of the *Fram* and the *St. Anna*, the tragic expedition of Lieutenant Brusilov.

Turning back to Cape Chelyuskin still no outlet to the west could be found. For a week the expedition waited, hoping for favorable winds in vain; further attempt was abandoned and the return journey begun. Ice, unfavorable winds, and the growing darkness of the nights added to the difficulties. Petropavlovsk was reached on October 29, where a stay for repairs was made. The expedition finally arrived at its base on November 25 after completing 13,000 miles of navigation.

WORK OF 1914-1915

The prime object of the 1914-1915 expedition was to complete the Northeast Passage and to continue the exploration of the newly discovered Nicholas II Land.⁵

⁴ See the note "Nicholas II Land," *Bull. Amer. Geogr. Soc.*, Vol. 46, 1914, pp. 117-120.

⁵ Cf. also the account "Vilkitski's North-East Passage, 1914-1915," *Geogr. Journ.*, Vol. 54, 1919, pp. 367-375.

On July 7 the expedition started out from Vladivostok *en route* to the Arctic. On the way news of the commencement of the World War was received from America through the radio station in Alaska. In order to get information thereon, the *Taimir* directed her course to Nome. Later through the radio station in the village of Novo Mariinsk on the Anadir River the *Taimir* got in communication with Petrograd and received instructions to proceed with the work in the Arctic Ocean and to try to reach Archangel. The *Vaigach* busied herself in the meantime with hydrological and hydrographical observations in the Bay of St. Lawrence

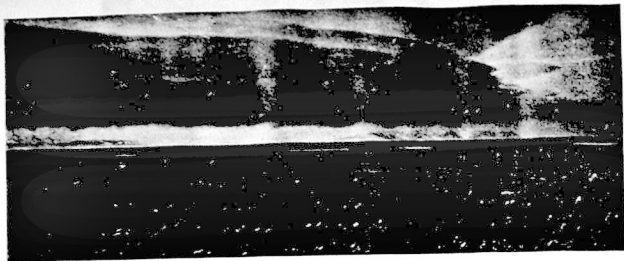


FIG. 17—The first sight of the new land—Nicholas II Land seen September 3, 1913.

and around the Diomed Islands in Bering Strait. Whilst they were thus engaged there came a request from the Canadian Government to render assistance to those members of Stefansson's expedition who, after the wreck of the *Karluk*, had been wintering under unfavorable conditions on Wrangel Island. The *Vaigach* proceeded thither. No efforts were spared to approach the island, which it was known would be accessible not longer than three weeks at most. The first attempts proving unsuccessful, the *Vaigach* tried the approach via Herald Island and the northeast but here met the same insurmountable obstacle—thick, piled-up ice. A slight wind from the north starting up, the vessel then tried to reach the southeast coast of the island but was pressed back. A mass of ice caught in the propeller. The *Taimir*, being informed by radio of the plight of the *Vaigach*, came up but on account of the ice could not approach nearer than ten miles. Eventually the *Vaigach* was freed, but the expedition had to give up the idea of trying to reach Wrangel Island, the work of rescue, it is subsequently learned, being accomplished by the American trading schooner *King and Winge* commanded by her owner Captain Olaf Swenson. At Kolyuchin Bay, on August 19, the vessels took on the last supply of coal from the *Tobol* which had been delegated to provision the ships, and on August 21 the vessels proceeded westward.

Beyond the meridian of Cape Billings an attempt was again made to reach Wrangel Island but without success. Near Cape Yakan, while

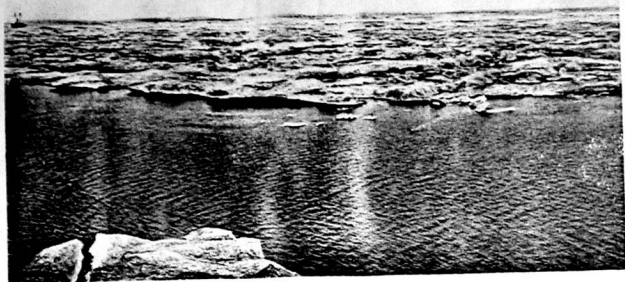


FIG. 18

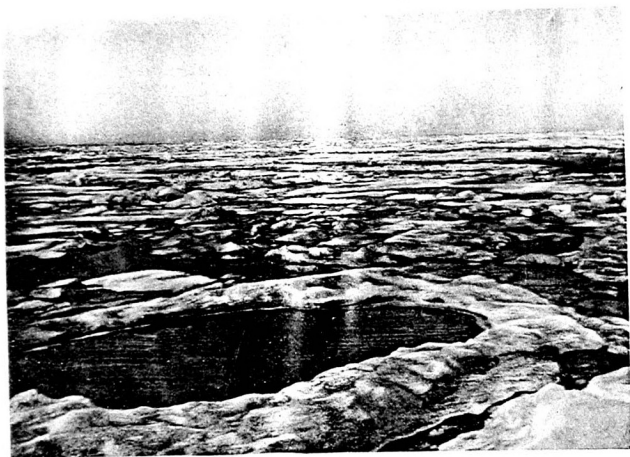


FIG. 19

FIG. 18—An old ice field in summer, the surface covered with dirt and fresh-water pools.
 FIG. 19—Detail of the ice field seen above.

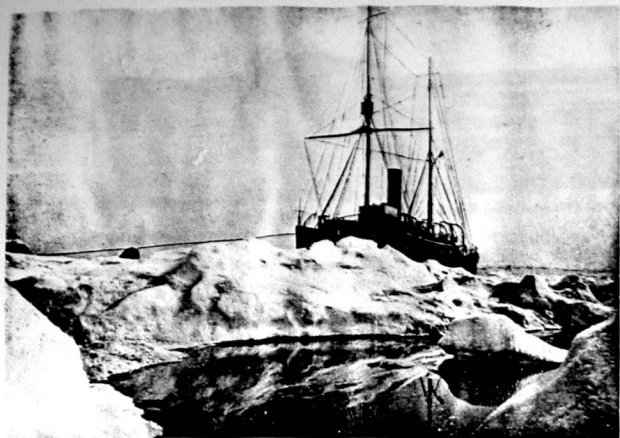


FIG. 20



FIG. 21

FIG. 20—The *Vaigach* blocked by the ice on attempting to approach Wrangel Island for the rescue of members of Stefansson's expedition from the wrecked *Karluk*.

FIG. 21—Walrus near the shore of General Vilkitski Island.



FIG. 22.—Icebergs grounded off the southwest coast of Nicholas II Land, preventing the westward advance of the expedition in 1914.

moving among broken pieces of ice, the expedition noticed a fire on a large ice floe; around the fire were grouped about twenty Chukchis who had been hunting walrus. They asked to be taken to the coast, but as we could not afford to lose any time their request was declined.

After passing the meridian of Chaun Bay the vessels separated, the *Vaigach* going along the coast to the Bear Islands and New Siberian Islands, the *Taimir* going as far north as the ice permitted. Insurmountable ice near the New Siberian Islands compelled the *Vaigach* to change its direction to the north, the intention being to reach the De Long-Jeannette groups and, if possible, also Henrietta Island. Heavy ice again barred the way, and the *Vaigach* made for General Vilkitski Island.

During this journey the *Vaigach* discovered and surveyed an island named Novopashenni, subsequently renamed Jokhov, the coördinates of which were determined as latitude $76^{\circ} 10' N.$ and longitude $153^{\circ} E.$ Here she was joined by the *Taimir*.

The vessels separated again, the *Vaigach* proceeding to the north of the New Siberian Islands, with the intention of completing the survey; the *Taimir* to Bennett Island and from there westward as far north as possible to ascertain the boundaries of the ice. Cape Chelyuskin was chosen as the rendezvous.

Shallow depths prevented the *Vaigach* from reaching the New Siberian Islands, and only four days later, on August 31, she approached the coast of the Taimir Peninsula without encountering ice on the way until between the Island of St. Samuel and the mainland.

The *Taimir* encountered bad conditions for navigation and was damaged on the way to the cape in collision with floating ice. Arrived at Chelyuskin on September 2 the expedition encountered large ice fields, which although broken offered little prospect of open water to the west. The vessels anchored near the cape, and a party from the *Taimir* was sent ashore. The ice fields now began to move in the direction of the place of anchorage. The *Vaigach* got under way and succeeded in passing the southeastern extremity of Nicholas II Land and, through a channel of open water in a southwesterly direction along its southern coast, reached a point in latitude $77^{\circ} 51' N.$ and longitude $99^{\circ} W.$ Here encountering

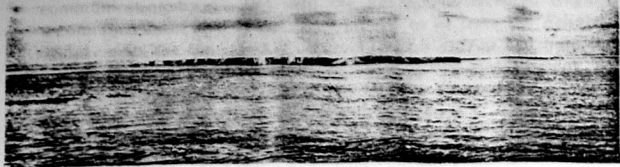


FIG. 23—Iceberg aground in 20 fathoms of water off the south coast of Nicholas II Land.

grounded icebergs the *Vaigach* turned back towards Tsarevich Alexis Island and made a survey of its southern coast and of some small islands adjacent.

The *Taimir*, delayed by awaiting the return of the shore party, was caught by the ice and drifted some fifteen miles east of the cape before she succeeded in freeing herself. She met the *Vaigach* on the southern coast of Nicholas II Land.

The vessels started out again to the west but, meeting the same obstacles, turned back and a few hours later anchored on ice under the low southern coast of the new land. While they were waiting there the approach of winter began to make itself felt: the temperature dropped, the tundra began to freeze, the pools were covered with new ice, snowstorms were frequent. During the following days up to September 9, the vessels maneuvered about in a general northwest-southeast direction, between the continent and Nicholas II Land, in search of an outlet to the west. They also anchored at the islands Axel Heiberg and Fernley, hoping that these islands, natural ice cutters when the drift is strong, would be of help. But the results were futile. The islands in the middle of the 30-mile strait stop the movement of the ice fields when weak winds are blowing. There were no fresh winds, and the summer temperature was low this year, an average of -2° C. for the season in the Arctic.

No considerable space of water was free from ice, and the lanes among the fields were unsafe. On September 9 the *Taimir*, upon entering such a lane, was pressed between ice fields; and, because of the hole sustained in collision with the ice, the vessel tilted on one side and could not take the ice properly. The pressure fortunately lasted not more than two to three minutes, but as it was, 70 ribs were broken and 9 water-tight bulkheads were stove in. Two or three days later the *Vaigach* entered open waters and moved along the western coast of the Taimir Peninsula to King Oscar Peninsula near the Taimir River, where she encountered heavy ice and in turn severe ice pressure. The *Taimir* found herself surrounded by ice fields, and preparations were made for walking to the coast in case repeated pressure destroyed the vessel. The necessary three weeks' supply of food and equipment was put on the upper deck.

During the night of the same day, i. e. September 9, the *Taimir*, while communicating by wireless with the *Vaigach*, intercepted fragments of a communication in Russian which proved to be from the *Eclipse*. This vessel under the command of Captain Otto Sverdrup had been sent out by the Russian Government in search of Lieutenant Brusilov and the geologist Russanov, who had set out in 1912 on an eastward voyage to Bering Strait and about whom nothing was known. Sverdrup informed us that he also was in a difficult situation because of ice. He was at that time near Cape Tillo, some 200 miles from us. Being informed of the

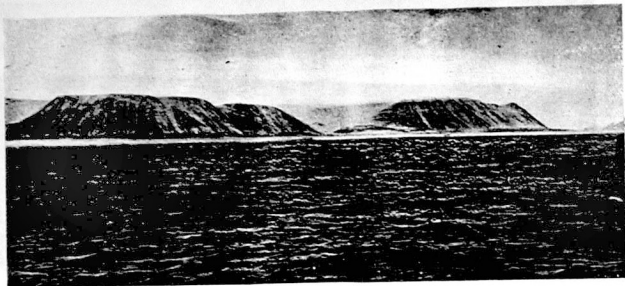


FIG. 24—The east coast of Nicholas II Land.

situation of the *Taimir* and the *Vaigach* he promised help with sledge parties: for he had 30 dogs. He gave information about the war, as he had recently received news by wireless from Yugor Strait, a connection now lost on account of the long distance. From that time on the expedition was in daily communication with Sverdrup up to October, after which, in order to save fuel, communications were limited to one a week.

WINTERING OFF THE TAIMIR PENINSULA

The situation continued precarious and it became increasingly apparent that the expedition would have to winter on the spot. Eventually the *Taimir* was anchored (September 26) as near shore as possible—at a distance of two and a half miles. The *Vaigach* anchored a mile and a half from the coast of King Oscar Peninsula.

The *Eclipse* reached Cape Vilda, latitude $75^{\circ} 40'$ N. and longitude $91^{\circ} 25'$ E. The vessels started preparations for the winter. Two sheds for the airplane and about one ton of provisions were transferred from the *Taimir* to the coast. This was done in anticipation of a wreck of the vessel during the ice-breaking period of the following year.

On October 19 a storm carried away ice from the shore to the north. The ice field and the *Taimir* with it were halted seven miles from the coast in latitude $76^{\circ} 41'$ N. and longitude $100^{\circ} 50'$ E. The *Vaigach* was situated

in latitude $76^{\circ} 54' N.$ and longitude $100^{\circ} 13' E.$ The distance between the two vessels was 17 miles.

The air-line distance between the vessels and the *Eclipse* was about 100 miles, and from the *Eclipse* to the radio stations in Yugor Strait, which were in touch with Petrograd through the radio stations in Archangel, 800 miles. This distance at first proved too great even for the *Eclipse*. The author of this article, a specialist in radiotelegraphy, succeeded, however, in making computations which, transmitted to the *Eclipse*, enabled her to get in touch with Yugor Strait by the middle of January.



FIG. 25—The ice that barred approach to the south coast of Nicholas II Land.

The winter was spent in overhauling the mechanism of the ships and, on the *Taimir*, in repairing the damage wrought by collision with the ice. Systematic meteorological and hydrological observations were made. The meteorological observations included exploration of the higher regions of the atmosphere by means of flying kites with a meteograph. Thanks to the perseverance of Lieutenant N. Evgenov, these observations were carried out continuously in spite of all obstacles, even during the polar nights. Observations of the ice were in charge of Lieutenant A. Lavrov. The cartographic work was under the able and enthusiastic direction of Lieutenant Neupokoev.

In addition to the regular work carried on the usual recreations of an Arctic wintering were indulged in, but the harsh weather together with the uncertainty about the war had a depressing effect on the personnel. Encouragement, however, was derived from the conversations with the experienced commander of the *Eclipse*.

Arrangements were made to take care of all eventualities. It was decided that should a second wintering be necessary, the expedition, provided with food for one half of its personnel, should transfer the second half to the *Eclipse*; this half was then to proceed over the tundra to the mouth of the Yenisei River, nearly a thousand miles away. Such a journey was, in fact, carried out. In case of wreckage of the vessels, it was planned that

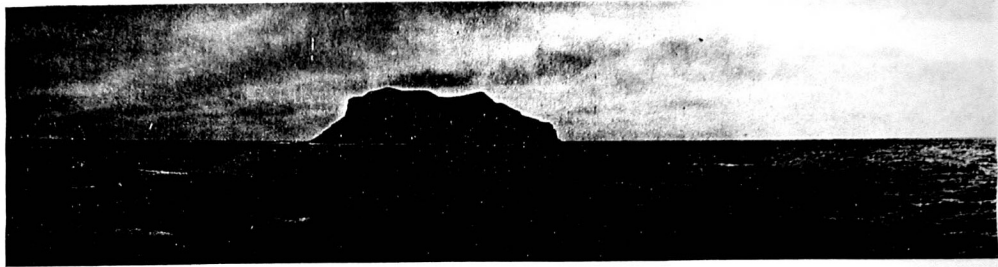


FIG. 26



FIG. 27

FIG. 26—General Vilkitski Island, discovered by the expedition on August 20, 1913.

FIG. 27—Preobrajenie (Transfiguration) Island, at the northern entrance to Khatanga Bay. The delineation of the coast line of the bay has been greatly changed as a result of the expedition's surveys.



FIG. 28



FIG. 29

FIG. 28—The bold cliffs of the eastern coast of Nicholas II Land.

FIG. 29—The entrance to Pronchishcheva Gulf. Sand spits in the foreground. This inlet, which runs at least 25 miles into the interior, was not shown on any existing map.

the remaining half of the expedition should make for the mouth of the Yenisei River and establish a winter base in Dickson Bay.

Meanwhile supplementary measures were taken by Petrograd. In the first instance, a relief party was sent to assist the men in reaching the village of Golchikha, 750 miles from the place where the *Eclipse* was anchored for the winter. The organizer and director of this party was Begichev, boatswain of the *Zarya*, energetic, intelligent, and experienced.



FIG. 30—Ruined hut in Pronchishcheva Gulf, believed to be one occupied by Lieutenant Pronchishchev in charge (1725-1736) of the Lena-Cape Taimir section of Bering's second expedition. The situation and character of the structure and what could be learned from the natives through Begichev, leader of the relief expedition to the Yenisei, point to such a conclusion. The remarkable preservation of wood in the Arctic is well known.

In the second instance, a river expedition was despatched from Krasnoyarsk and down the Yenisei River; it took along portable wooden houses, provisions, and equipment for half the personnel of the *Taimir* and *Vaigach*, in case it should be necessary to spend the winter there. It was also provided with equipment for a radio station, which was to be in contact with Yugor Strait, and with coal for the vessels. The organizer and director of this party was Dr. Kushakov, a member of the Sedov expedition on the *St. Foka*, who, on Sedov's death, took his place and brought the expedition to a successful conclusion.

The two expeditions, thanks to their leaders, accomplished all that was required of them. Begichev's expedition was carried out in full. The buildings put up in Dickson Bay did not prove of much use, but the radio station and the meteorological stations were very useful during the war: in the absence of daily meteorological bulletins from abroad, the bulletins issued by the Dickson Station concerning the weather on the front took the place of those issued by the western countries.

By the middle of April a change of weather was noticeable; the first spring birds made their appearance. On May 12 Captain Sverdrup came to the *Taimir* and remained until the 19th, when he returned to his vessel with a party from the *Taimir* and the *Vaigach*. On July 5 Begichev reached the *Eclipse* with 650 deer, 200 of which were for the needs of the Samoyeds and their families, they being the owners of the herd. On the 15th Begichev and the party from the *Taimir* and the *Vaigach* left the *Eclipse* and

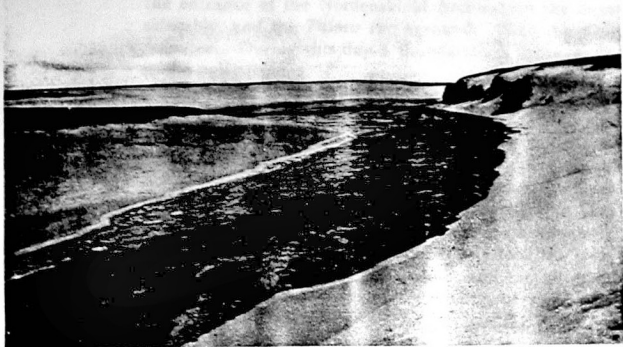


FIG. 31—The river discovered west of Cape Vilda.

started out for the mouth of the Yenisei, the deer carrying the freight. The journey was made in about a month and a half.

During May the tundra began to be enlivened by the presence of birds, and by the end of the month the temperature had risen to 3.6° C. The ice stopped increasing after it had reached a thickness of 150–200 centimeters, according to the thickness of the layer of snow upon its surface. From the middle of May to the beginning of July excursions to the land were inaugurated. An astronomical station was established on the coast, the customary beacon being erected. A survey of parts of the coast and its bays was made. During the preceding autumn the *Eclipse* had discovered the mouth of a new river west of Cape Vilda. Dr. J. J. Trjmeski and the writer undertook a sledge journey thither in June. The spring break-up had commenced, however, and it was impossible to stay for any further exploration. According to Begichev the river runs from the mountains south of the tundra and thus is of considerable length. The work carried out by Lieutenants A. Lavrov and N. Evgenov showed that Haffner Fiord is closed, disproving the previous supposition of a water connection with St. Thaddeus Bay on the eastern coast of the Taimir

Peninsula. A frozen mammoth with tusks eight feet long was found by one of the shore parties. For the shore excursions the hydro-aeroplane—which otherwise had proved useless—was converted into aero-sledges.

Between the 20th and 30th of July the first open spaces among the ice masses appeared, and the vessels began to drift. On July 28 the *Taimir* tried to free herself from the ice but without success. On August 8 openings appeared in the surrounding ice field, and two days later with the aid of an easterly wind the vessels freed themselves and, entering open water near the mouth of the Taimir River, started on their westerly course. At the entrance of the Nordenskiöld Archipelago the depths decreased considerably, and the *Taimir* ran aground. With the *Vaigach's* aid she was refloated. During this day a thunderstorm arose, a strange phenomenon in the polar regions.

Impassable ice now held the vessels back near the Vilkitski Islands. Not until August 27, after hard ice cutting, did they succeed in escaping to the westward. On August 28 the vessels passed Cape Vilda and on the following day met the *Eclipse*, which had freed herself on August 10 and had gone to Dickson Bay to get coal for the expedition's ships. In the meantime the steamer of the river expedition arrived in Dickson Harbor from Golchikha bringing news of the arrival there of the party from the vessels. The *Vaigach* proceeded to Golchikha and took the men on board. From Dickson Bay the *Eclipse*, the *Taimir*, and the *Vaigach* entered the Kara Sea, which was crossed without ice being encountered. The *Eclipse* then passed the Iron Gates, and the *Taimir* and the *Vaigach* proceeded through Yugor Strait.

On September 14 the vessels anchored at Cape Kanin, as they were instructed by radio not to enter the throat of the White Sea because mines had been laid there by German submarines. They met the ice-cutting ship *Brus* near the Cape and, escorted by it, arrived on September 16 in Archangel, where they were received with acclamation. The Northeast Passage had been made from the side of the Pacific Ocean, thus fulfilling the aim of the expedition—the exploration of the Great Northern Sea Road.

CONCLUSION

The war and the revolution have prevented the working up of the greater part of the scientific results of the expedition, especially the more interesting data pertaining to its latter years. It is, however, possible to draw some conclusions regarding the economic objective. It may be conditionally stated that the Northeast Passage is impracticable for commercial purposes. Even steamers of special construction would not make it if ice conditions were unfavorable. Favorable conditions depend in part upon high temperature in the summer, still more upon the occurrence of southerly winds: if such winds prevail, and especially if they are strong, the ice will break, and steamers can pass through; in the absence of such winds, they



FIG. 32

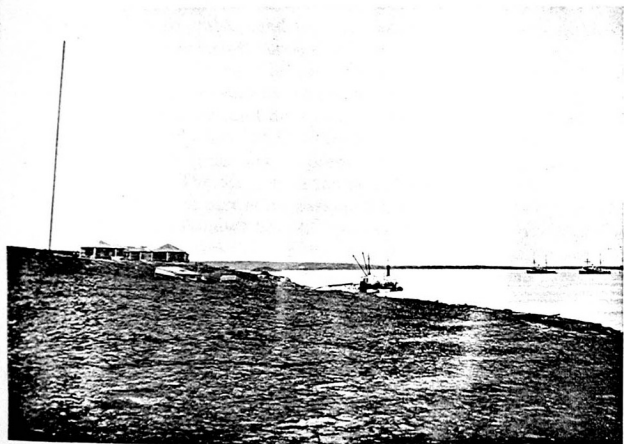


FIG. 33

FIG. 32—The *Taimir* in winter quarters off Cape Chelyuskin. Meteorological station on the ice.

FIG. 33—Dickson Harbor to the northeast of the Gulf of Yenisei. The wireless and meteorological station erected here proved of great use during the war.

cannot. This condition applies primarily to the region of Cape Chelyuskin, where, through the discovery of the new land to the north, there has been shown to exist instead of free water a strait only 50 miles wide, with islands in the middle and an archipelago of islands to the west.

Unfavorable ice conditions were observed by the expedition in 1913-1914. On the other hand, the *Vega* (1878-1879), the *Fram* (1893), and the *Zarya* (1901) enjoyed on the whole good conditions. The *Zarya*, during the preceding year, had been compelled to winter at the Nordenskiöld Archipelago where, in 1915, the *Taimir* and the *Vaigach* had broken through to the west with great difficulty. Amundsen in the *Maud* was compelled to winter twice in making the Northeast Passage in 1918-1920, first at Cape Chelyuskin, secondly off Chaun Bay.

We may, however, regard this question of navigability from another viewpoint—the utilization of the separate sections into which the route is naturally divided. These are: from the Kara Sea to the Kjellman (Minin) Archipelago; from the Kjellman Archipelago to Cape Chelyuskin; from Chelyuskin to the mouth of the Lena River; from the mouth of the Lena to the mouth of the Kolima River; and from the Kolima to Cape Dejnef.

The Kara Sea section, into which empty the powerful rivers Ob and Yenisei, presents during a certain period of the year, short though it is, favorable conditions for navigation and is passable. This section is of considerable economic importance.

The next region trends considerably to the north, is surrounded by islands and by an archipelago of islands which hinder the breaking up of the ice, and does not receive the discharge of rivers powerful enough to influence the ice. In consequence it is unfavorable for navigation. On the other hand it presents much of scientific interest.

The next region can be considered as a section by itself along the littoral, or as part of the passage to Cape Dejnef by way of the New Siberian Islands or Bennett Island. The varying ice conditions, which sometimes held back the expedition in this section, lead to the conclusion that it is not accessible and is risky for ordinary vessels. The littoral part trends sharply south with shallow waters, due to deposition from the Khatanga, Anabara, and Olenek Rivers. The northern part remains to be explored: various indications point to the existence of islands here, though this was not confirmed by the expedition of 1913-1914.

The region from the Lena to the Kolima is favorable as regards ice conditions because of the influence of the Lena, Yana, and Indigirka Rivers, but for the same reason it is shallow. This region is navigable.

The region from Kolima to Cape Dejnef is in a lower latitude and is easy of access. It is navigable but only from the beginning of August, when it frees itself from ice on the line from North (Syeverni) Cape to Wrangel Island. Its economic rôle in relation to the Yakutsk region is similar to though less important than that of the Kara Sea in relation to the basins of the Ob and Yenisei.

It should further be remarked that the waters off the Siberian coast are extremely rich in animal life—especially walrus and whales (near Bering Strait); the rivers and their mouths are also rich in fish, including some highly esteemed kinds. Coal, graphite, gold, and silver have been found in many places in northern Siberia; the Chukotsk Peninsula, according to geological opinion, is related to the Alaskan Peninsula, from which it is separated by a strait of about thirty miles, and contains the same natural resources as Alaska;⁶ but here and westward, along the entire Siberian coast, the potential wealth can only be guessed at for lack of adequate knowledge.

APPENDIX

NOTES ON THE MAP

The compilation of the map is based on:

1. The work of the Russian Hydrographical Expedition to the Arctic Ocean, 1910–1915 (from Cape Dejnef to the meridian 99° E. from Greenwich, Russian H. O. Charts Nos. 984, 985, and 986, of 1923).
From the meridian 99° E. from Greenwich to the west, data obtained by the Russian Hydrographical Expedition in 1915 on its way from the wintering place to Archangel are not shown on the new charts. Also very little is shown on Chart No. 986 of the strait between the mainland and Nicholas II Land, where in search of a passage to the west in 1914 the expedition spent over three weeks maneuvering across the strait, making landings on the southern shore of Nicholas II Land and Fernley and Heiberg Islands and taking many soundings.
2. Lieutenant A. V. Kolchak's work on the *Zarya* expedition 1900–1902 (from the meridian 99° E. to Dickson Harbor), Russian H. O. Charts Nos. 712 and 681.
3. The work of other Russian hydrographic expeditions (from Dickson Harbor to Archangel), various Russian H. O. charts up to 1916 with some additions and corrections up to 1924; latest British and United States charts.
4. Lieutenant G. L. Brusilov's polar expedition; Russian H. O. Records of 1914, Vol. 38, Issue I.
5. The map of Alaska (1:1,250,000) prepared by the American Geographical Society for the Alaska Road Commission, 1923.

Drift and soundings of the *Jeannette*, the *Fram*, the *St. Anna*, and the *Karluk* are taken from the respective official reports. The route of the *Maud* is not shown because no soundings were available; her survey of the two fiords of Thaddeus Bay in 1918–1919 has been made use of (H. U. Sverdrup: *Maud-ekspeditionens videnskabelige arbeide 1918–19 og nogen av dets resultater*, Separate from *Naturen*, January–April, 1922, pp. 5–88; map on p. 11).

Maps of Novaya Zemlya showing the results of Lieutenant Sedov's expedition, 1912–1914, have not been available to the author.

Franz Josef Land is drawn from the British Admiralty Chart No. 2282; and it is doubtful if the results of the Sedov expedition, which wintered in 1913–1914 near Cape Flora, were used.

The soundings taken by the *Eclipse* on her way from Lieutenant Khariton Laptev Land to Lonely Island and back to Dickson Harbor were not available.

In plotting the routes of the expedition, use was made of available soundings. No log books or other documents were available with the exception of photographed

⁶A. H. Brooks: *The Value of Alaska*, *Geogr. Rev.*, Vol. 15, 1925, pp. 25–50.

sketches of the routes of 1912 and 1913. In consequence the routes as shown are subject to revision and correction. Where confusion would arise through crowding of lines, details have been omitted and the routes generalized.

Astronomical observation stations are shown on the map. In order from east to west they are: C. Dejnev, C. Serdtse Kamen, northeast of Kolyuchin Bay, C. Onman, west of C. Syeverni, C. Billings, east of C. Kiber, C. Shelagski, C. Medvyeji, southeastern extremity of Chetirekh-Stolbovoi I., southeastern extremity of Krestovski I., Wrangel I. (between C. Thomas and Blossom Pt.), C. Titki, Blijni I., C. Svyatoi Nos; north coast of Mali I., southern extremity of Stolbovoi I., southeastern extremity of Jokhov I., C. Paks, Pronchishcheva Gulf, St. Andrew I., western island of St. Samuel Is., east coast of Nicholas II Land, west coast of Taimir Peninsula (near winter quarters of ships).

ICEBERGS

In the entire stretch of ocean from Cape Dejnev to Cape Chelyuskin and farther westward the expedition encountered icebergs only in the vicinity of Nicholas II Land. Icebergs were met here in 1913 at the southeastern end of the land, here aground in 70 fathoms of water, and at the northern end, and in 1914 tabular and other forms of icebergs were met at the southwestern end of the land aground in 20 fathoms.

It is impossible to state definitely the place of origin of these bergs as there are almost no data concerning the currents in the waters of the broad continental shelf from Cape Dejnev to Novaya Zemlya.

Glaciers of Bennett Island give rise to icebergs, but they are quite insignificant; the eastern coast of Nicholas II Land has glaciers giving rise to bergs on the eastern shore. Nothing is known of the western coast of the land.

The simplest solution is to suppose that the icebergs met were the product of the known glaciers of Nicholas II Land, those icebergs seen at the southwestern end of the land having been drifted there from the eastern shore by the resultant forces of still unknown deep-water and superficial local currents and predominant winds. The comparatively insignificant size of the icebergs is in harmony with such a hypothesis. It is also conceivable that the western shore of Nicholas II Land has glaciers and that the icebergs seen at the southwestern end of the land had been drifted from there by opposite forces of currents and wind.

But, extending the question beyond these local limits, another supposition may be reached. Schokalsky, in his well-known treatise on oceanography¹ says that "the more northerly branch of the North Cape Current would seem to reach the northern shore of Novaya Zemlya, a portion passing between that island and the archipelago of Franz Josef to latitude 80° N. which it would seem to double from the east; by its mass of water this is the strongest branch of the North Cape Current."

The North Cape Current itself, as is known, is a branch of the North Atlantic Drift, and the other and stronger branch of the same current, the so-called Spitsbergen Current, passes along the western shore of Spitsbergen, doubles its northern end, and constantly sinking deeper beneath the colder but fresher and less dense waters turns to the right, i. e. to the east, in consequence of rotational deflection.

Could we not attribute a similar easterly deflection to the northern branch of the North Cape Current rather than suppose a route to the north along the eastern shore of Franz Josef Land?

We can then imagine that icebergs of the southern shores of Franz Josef Land or even off the eastern shores of Novaya Zemlya immersed 50 meters and more

¹ J. M. Schokalsky: *Okeanografia*, Petrograd, 1917 (reviewed in *Geogr. Rev.*, Vol. 14, 1924, pp. 679-680). See also the map, North Polar Sea, Pl. I, in "Meteorologii i okeanografii Karskago i Sibirskago morei," Petrograd, 1918. For a photostat copy of this latter work the American Geographical Society is indebted to M. Stanislas Reizler, librarian of the Société de Géographie, Paris.

would come under the influence of that deep-water current and would drift along the continental shelf to Nicholas II Land. This hypothesis is not contradicted by the drift of the *St. Anna*, which indicates the direction of the superficial current of the Kara Sea under the influence of the waters of the Ob and Yenisei and of the predominant winds.

There are analogous examples. The presence of great bergs at the western shore of Novaya Zemlya has frequently been observed,⁸ and their origin from Spitsbergen or Franz Josef Land is deduced on the ground of their size, which surpasses that of the bergs from Novaya Zemlya. At the same time a cold superficial current carries ice from Franz Josef Land to Bear Island, and the existence of another cold superficial current to the north along the western shores of Novaya Zemlya and in the strait between that land and Franz Josef Land is suggested by the drift of the *Tegethov* to the north.

As to the superficial currents of the Kara Sea itself and also the current of the strait between Novaya Zemlya and Franz Josef Land, the deflection towards the east on the parallel of Cape Jelaniya in the drifts of the *St. Anna* and the *Tegethov* suggests the influence of the North Cape Current. But such influence on the ice fields and drift of ships is naturally less than the forces determining the direction of the superficial current; while for the icebergs, on the contrary, the influence of the deep-water current is greater than other causes.

The above suggestion, however, is offered as a mere hypothesis. The question calls for study with all available material.

HYPOTHETICAL LANDS: SANNIKOV LAND AND ANDRÉEV LAND

Complete historical data concerning Sannikov Land are found in "Die Russische Polarfahrt der *Serja*, 1900-1902," including the diaries of Baron Toll, head of the expedition, found by Lieutenant A. V. Kolchak on Bennett Island. Briefly, the account is as follows. In 1805 the hunter-trader, Jacob Sannikov, saw a land to the north from the northern cape of Kotelni Island. The next year he also saw land to the north from Novaya Sibir. As the existence of the latter (Bennett Island) was subsequently proved by Lieutenant De Long, Sannikov's claim could not be dismissed by Baron Toll notwithstanding the negative result of the extensive explorations made by Lieutenant Anjou in the twenties of the last century. In 1886 Baron Toll, during his first expedition to the New Siberian Islands, says that he himself saw from the northern end of Kotelni Island land lying 14° - 18° to the north-east. He estimated the distance of this land as a degree and a half or two degrees from the northern end of Kotelni Island. But it was not seen by Baron Toll himself from the extreme point reached by him in 1901 on the *Zarya* somewhat south of the supposed position of this hypothetical land, nor was it seen by our expedition of 1913, the route of which crossed this region a degree and a half north of Kotelni Island, nor was land observed to the south of this point by the expeditions of 1913 and 1914. If it exists it must be looked for farther to the north and, according to the drift of the *Fram*, probably to the east also.

As to Andréev Land, seen by Andréev in 1763, there are no positive data about it except his own statement. On the contrary, all observations up to Wrangel's inclusive suggest a negative solution of this problem.

Briefly the story of this land is as follows.⁹ Plenitsner, a member of Commander Bering's expedition in 1741, traveled to the Anadir peninsula by order of the Governor of Siberia to determine the possibilities offered for settlement. From its Chukchi inhabitants he learned that a great land lay north of the Kovima (later Kolima) River, called Imoglin, and to its discovery he despatched Sergeant Andréev.

⁸ See, for instance, A. E. Nordenskiöld: *The Voyage of the Vega* (2 vols., London, 1881), Vol. 1, p. 182.

⁹ V. N. Berkh: *Chronological History of All the Travels to the North Polar Countries*, St. Petersburg, 1821.

Andréev left Nijne-Kolimsk in March, 1763, and on April 22 entered the Arctic Sea from the Krestovaya River, whence he reached the Bear Islands. He saw nomad tents everywhere; and on the eastern part of the horizon, somewhat to the north, he saw "blue,"¹⁰ but he did not assert it was land. Lacking food for his dogs he returned to Nijne-Kolimsk. Berkh supposes that Andréev made a second journey in 1764, for in the supplementary article of the instructions to Captain Billings, 1787, it is mentioned that from the farthest of the Bear Islands Andréev saw a far-away land to which he started, but at 20 versts' distance from it he noticed signs of a multitude of deer-riding people and, having few men with him, returned to Nijne-Kolimsk.

Andréev's statements were in part responsible for the organization and despatch of a series of expeditions from 1767 to 1823—Leontiev, Lissov, and Pushkarev in 1767–1769, who described the Bear Islands; Captain Billings in 1787; and Wrangel in 1821–1823.

Various northern latitudes reached by these expeditions gave no confirmation of the existence of such land. The *Jeannette* drift bounds the possible position of this land on the north.

Judging from the fragmentary data available, the drift of the *Maud* in 1920–1923¹¹ from Wrangel Island to the northwest was generally parallel with that of the *Jeannette* but on the average 50 miles south of it, whereby this area, together with the route of our expedition in 1911–1914 bordering its southern and western boundaries, has been still more contracted.

However, the fact that constant efforts of our expedition to get into that unknown region from the southeast, south, and west invariably met obstacles in the form of heavy and absolutely impassable ice (see the map) strengthens the possibility of the existence of land, and the problem remains open.

In addition to the drifts of the *Fram*, the *Jeannette*, and the *Tegethov* we have now the drifts of the *St. Anna*, the *Karluk*, and the *Maud*—the last unavailable in detail. It would be interesting to study the zigzags of all these drifts on the basis of hydro-meteorological data with a view to determining the connection, if any, between these zigzags and adjacent lands.

The ocean depths east of the New Siberian Islands are quite unknown. The few depths surpassing 50 meters to the north and southwest of Wrangel Island and on the meridian 160° E. do not permit us to draw any conclusions as yet.

If the observations of the flight of birds from the north, made by our expeditions, give further suggestion of the possibility of land in that region, on the other hand the *polynija* (see footnote 10), channels of open water often seen here in winter, offer evidence of a contradictory nature—that the ice is in movement here during the winter, i. e. that this region is in touch with the polar ice pack and outside of the land-fast ice. The drift of the *Maud* newly confirms the drift of the *Jeannette* in this respect and shifts still farther south the northern boundary of the land-fast ice.

The invariably heavy accumulation of ice in the southern part of the region observed by the expedition may be explained either on the supposition of the shoaling of the sea bottom in the middle of this region within the limits of 50 meters depth, or on that of the existence of some local superficial current which might explain the origin of the ice fields as well as the accumulation of ice.

However this may be, the region remains one of the unexplored areas along the northern coast of Siberia.

¹⁰ Evidently a reflection of the *polynija*, the channel of more or less open water that separates the land-fast from the moving ice. On the *polynija* in this region and elsewhere in the Arctic Ocean see J. Schokalsky: La circulation dans les couches superficielles de la mer polaire du Nord, *Ann. de Géogr.*, Vol. 33, 1924, pp. 97–104.

¹¹ *Geogr. Journ.*, Vol. 65, 1925, pp. 84–85.

